The Impact of the Terms of Trade Volatility on Economic Growth: Evidence from Oil Exporting Countries

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Abstract-**The Terms of trade volatility has often been associated with poor economic performance in commodity dependent developing countries, but little research has been done for these countries, in particular oil exporting countries. This paper evaluates the impact of the Terms of Trade volatility (TOTV) on economic growth (GDP) in oil exporting countries using GMM method during 1980-2005. The results indicate that economic growth depends positively on the current level of the terms of trade, while volatility in the terms of trade has a negative impact on growth.**

Keywords-Economic Growth; Primary Commodities; Terms of Trade; Price Volatility; GMM Method

I. INTRODUCTION

Historically, two arguments have been advanced to the effect that specialization in the export of primary products is disadvantageous to growth. One is the Prebisch–Singer thesis that the price of primary products is on a long-run downward trend relative to the price of manufactures. The other is that, because of the volatility of primary product prices, exporters of these products experience greater instability of export revenue. Neither of these arguments has received much support in the professional literature in recent years. Analysis of data back to the beginning of the 20th century has shown that any long-run downward trend in the relative price of primary products is sufficiently slow that it can plausibly be explained by quality improvements in manufactures which are not captured in the price indices ([1], [2]). The evidence for greater export revenue instability amongst exporters of primary products is mixed ([3], [4]). Nevertheless, there is increasing evidence that specialization in the production of primary products may be harmful to growth. [5] report the 1970 share of primary exports in GDP to have a significantly negative coefficient in a growth regression for 83 countries over the period 1965–1990, and [6] finds the 1970 share of primary products in total exports to be robustly and negatively correlated with growth over many alternative regression specifications (As well see [7]–[9]).

If these findings are correct, then what is the mechanism? Some recent theories focus on the Institutional and political economy effects of natural wealth ([10]–[13]) or on the disincentive to investment in human capital because of the higher returns to unskilled labor ([14]). These arguments are open to [15] objection that growth performance is much less persistent than these theories would imply. Another possibility is that the trends in the relative price of primary commodities over the recent period have been significantly more unfavorable than the long-term average. This appears to have been true, but if it were a sufficient explanation, then the initial primary product share should be insignificant in growth regressions when the trend in the terms of trade is added, which does not happen.

Another possibility, and the one on which this paper focus here, is that export price volatility is an important factor. In recent years, some significant new ideas have appeared in this respect. One relates to developments in the theory of investment, where the combination of irreversibility and uncertainty is now recognized to yield an option value of delaying investment ([16]). Another derives from empirical studies of developing countries, especially oil exporting countries, in the last 25 years, during which period terms of trade shocks have been larger than in the period 1955–1970. It has quite frequently been argued that even windfall gains have often been wasted, because governments have misread them as permanent and made spending commitments that are not easily reversed, ending up with significant macroeconomic imbalances ([17], [18]). Recent detailed studies of terms of trade shocks in developing countries have, however, come to much more positive conclusions about the management of shocks ([19]–[22]).

However, studies about of the terms of trade volatilities and their effects on economic growth in oil exporting countries are scarce. This paper use data from a sample of net oil exporting countries which are heavily dependent on the export of crude oil to investigate the effects of terms of trade uncertainty on growth. The focus on net oil exporting countries reflects the intuition that if volatility matters at all, it should do so in these countries most dependent on primary products.

The rest of the paper is organized as follows. Section 2 discusses the theoretical issues. Next section describes the data and methodology. Section 4 present empirical results. Section 5 concludes.

II. THEORY

The recent model of [23] provides a good starting point for discussing the relationship between terms of trade dynamics and economic growth. He examines the impact of terms of trade movements on consumption growth within a stochastic growth model. Consumers maximize expected lifetime utility as given by:

$$U(C) = E\left[\sum_{t=0}^{\infty} \beta \frac{c_t^{1-\gamma}}{1-\gamma}\right]$$

$$\gamma > 0, \qquad 0 < \beta < 1$$

Where C represents consumption of the imported good and b is a subjective discount factor. Savings are invested in a perfectly durable asset that produces the export good subject to a linear technology with a stochastic gross return of R per period. The consumption-based return on savings is equal to R times one plus the proportional rate of change of the terms of trade which we denote by Mendoza assumes that the change in the terms of trade follows a stochastic process with known variance and mean. He then shows that planned consumption growth is an increasing function of the trend in the terms of trade (i.e. the mean of z), but is negatively related to terms of trade volatility (the variance of z) only if $\gamma < 2$, (if $\gamma > 2$, this relationship is positive). In the empirical part of his paper, Mendoza shows that, for a sample of 40 industrial and developing countries over the period 1971–1991, the predicted positive relationship between consumption growth and the change in the terms of trade is confirmed, while there is also a significant negative relationship between consumption growth and terms of trade volatility.

The strong predictions of this model with respect to the impact of the trend in the terms of trade on consumption growth do not carry over to output growth. Ignoring the stochastic element, wealth (A) and, therefore output, grows according to the following equation:

$$A_{t+1} = \beta^{1/\gamma} R^{1/\gamma} Z_t^{1/\gamma - 1} A_t$$

It is clear that output growth is positively correlated with z only if $\gamma < 1$. Since the purchasing power of output over the imported consumption good grows at a rate z, we have:

$$C_{t+1}/C_t = Z_t A_{t+1}/A_t$$

Substituting this into Eq.(2) yields:

$$C_{t+1} = \beta^{1/\gamma} R^{1/\gamma} Z_t^{1/\gamma} C_t$$

Hence, Mendoza's strong result for consumption growth. On the other hand, the impact of volatility of the terms of trade on output growth is similar to its effect on consumption growth. It follows that the sign of the relationship between output growth and both trend and volatility of the terms of trade depends on the value of γ. Thus, even in the special case of an isoelastic utility function, the model's theoretical predictions are rather ambiguous, given that the appropriate value of γ is highly uncertain.

III. DATA AND METHODOLOGY

This paper evaluates the impact of the Terms of Trade volatility (TOTV) on economic growth (GDP) in 20 oil exporting countries[1] using GMM method during 1980-2005 considering availability of data. As well, data extracted from World Bank. Likewise, in order to interpreting the elasticity of the variables, they are terms of logarithm. The simple regression that is estimated as below:

$$LGDP = F(LK, LL, LTOT, TOTV)$$

Where LGDP denotes logarithm of GDP, LK is logarithm of capital formation, LL is logarithm of labor force, LTOT is logarithm of the Terms of Trade and TOTV is the Terms of Trade Volatilities. In constructing a measure of volatility it is important to distinguish between sample variability and 'true' uncertainty. Hence, it is needed a measure which reflects only the unpredictable innovations in the terms of trade. A simple sample volatility is not acceptable as it may overstate uncertainty by including cyclical movements and trends, which are party predictable from past data. Additionally, in order to examine the effect of uncertainty on dependant variable, it is needed a time variant level of uncertainty. Thus, it is generated a variable conceptually comparable to this notion of uncertainty by applying a GARCH model to the innovations in the terms of trade. More specifically, following the work of [24], it is estimated the following univariate GARCH (1,1) model:

$$\Delta TOT = \propto_0 + \propto_1 T + \beta_1 \Delta TOT_{-1} + \varepsilon_t$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \mu \sigma_{t-1}^2$$

Where TOT denotes the terms of trade, ΔTOT is the first difference of the terms of trade and σ_t^2 is the variance of ε_t conditional on information up to period t. Thus the measure of uncertainty which is dependent on both time and the predictable movements in the terms of trade embodied in ε_t.To specify the empirical model properly, an important step is to test for unit roots and stationary. Consequently, it was implemented using the Im, Pesaran and Shin (IPS) test. IPS test assumes the series are non-stationary, hence failure to reject the null hypothesis implied the time series has a unit root. Then, the generalized method of moment model is estimated using the first differences and orthogonal deviation. However, for the purpose of this study only first difference estimation is employed. The GMM first differencing method was introduced by [25], [26] to solve for the problem of inconsistency and biased estimates. [27] also employed generalized method of moments to estimate dynamic panels with lagged dependent variables.

IV. EMPIRICAL RESULTS

Before running the regression, it is important to consider whether the data series are stationary or non-stationary. Table I presents the results of Im, Pesaran and Shin (IPS) unit root test. IPS test assumes the series are non-stationary. IPS statistics indicate that all variables are stationary at level.

TABLE I IPS UNIT ROOT TEST

Variables	**Level**	**Prob.(0.05)**	**Result**
LGDP	-1.96	0.024	I(0)
LK	-2.74	0.003	I(0)
LL	-2.32	0.001	I(0)
LTOT	-4.75	0.000	I(0)
TOTV	-6.35	0.000	I(0)

In the presence of dynamic and endogenous regressor, neither the random effects model nor fixed effects estimator produces consistent results. Therefore, for these reasons, GMM is employed in this study in an attempt to obtain consistent results. Moreover, the coefficient of the lagged economic growth can also be used to determine whether there is convergence amongst the sample countries ([28]). Regression results for the GMM estimation method are presented in Table II. The results indicate that Growth depends positively on the current level of the terms of trade, so that one percent favoring in TOT induced Growth increase by 0.04 percent. Furthermore, With respect to volatility, there is a negative effect of terms of trade instability, so that one percent increase in TOTV causes Growth decrease by 0.31 percent. However, the positive impact of the terms of trade is consistent with the interpretation of balance of payments constraints as a limiting factor in developing countries' growth ([29]). Terms of trade effects regularly emerge as significant in growth equation ([2], [15], [30]), and our findings reinforce this conclusion.

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[1] Algeria, Angola, Armenia, Bahrain, Egypt, Georgia, Greece, India, Indonesia, Iran, Kazakstan, Georgia, Greece, India, Indonesia, Iran, Kazakstan, Kyrgyzstan, Lebanon, Malaysia, Oman, Pakistan, Philippine, Singapore, Turkey and Uzbekistan

Moreover, the findings show that volatility in terms of trade has much more important effect than the current level. Hence, high TOT volatility might result in sub-optimal inter-temporal allocation of revenues, characteristic of resource economies, which could be deleterious to growth. In that case, however, reducing the volatility through delinking public revenues from such volatility would be the appropriate strategy for addressing the resource curse. Likewise, as expected, the effects of labor and capital formation on Growth are positive and significant.

Furthermore, the validity of instruments in GMM method is tested using a Sargan test. The joint null hypothesis is that the instruments are valid instruments (i.e. orthogonal to the residuals) and that the estimated model is correctly specified. Under the null, the test statistics follows a chi-squared distribution with the number of over-identifying restrictions for degrees of freedom. The result of Sargan test shows that the estimated model is correctly specified.

TABLE II GENERALIZED METHOD OF MOMENTS MODELS (GMM)

Dependent variable: GDP growth	
LGDP(-1)	-0.220 (-4.97)*
LK	0.375 (4.63)
LL	0.561 (5.12)
LTOT	0.048 (2.10)
TOTV	-0.314 (-2.48)
R^2	0.78
Sargan test	0.65

*Figures in parentheses are *t*-statistics.

V. CONCLUSIONS

Recent research has suggested a negative correlation between specialization in primary product exports and growth. This paper evaluates impact of the Terms of Trade volatility (TOTV) on economic growth (GDP) in oil exporting countries using GMM method during 1980-2005. These countries are heavily dependent to exports of primary goods (oil). Theory is ambiguous on the effects of level and volatility of the terms of trade on growth. The results indicate that Growth depends positively on the current level of the terms of trade, while volatility in the terms of trade has a negative impact on growth. Also, that volatility in terms of trade has much more important effect than the current level. Hence, it is appeared reducing the TOT volatility in the oil exporting countries through delinking public revenues from such volatility would be the appropriate strategy for avoiding from deleterious effects on economic growth.

REFERENCES

[1] E.R. Grilli and M.C. Yang, "Primary commodity prices, manufactured goods prices, and the terms of trade of developing countries: what the long run shows", World Bank Economic Review, vol. 2, pp.1–48, 1988.

[2] M.F. Bleaney and D. Greenaway, "Long-run trends in the relative price of primary commodities and in the terms of trade of less developed countries", Oxford Economic Papers, vol. 45, pp.349–363, 1993b.

[3] P. Brock, "Export instability and the economic performance of developing countries", Journal of Economic Dynamics and Control, vol.15, pp. 129–147, 1991.

[4] A. Maizels, "Commodities in Crisis", Oxford University Press, Oxford, 1992.

[5] J.D. Sachs and A.M. Warner, "Fundamental sources of long-run growth", Papers and Proceedings of the American Economic Association, vol.87, pp.184–188, 1997.

[6] X.X. Sala-i-Martin, "I just ran two million regressions", Papers and Proceedings of the American Economic Association, vol. 87, pp.178–183, 1997.

[7] J. Baland and P. Francois, "Rent-seeking and Resource Booms",Journal of Development Economics, vol. 61, pp. 527–542, 2000.

[8] R. M. Auty, "Resource Abundance and Economic Development", Oxford University Press, 2001.

[9] R. Torvik , "Natural Resources, Rent Seeking and Welfare", Journal of Development Economics, vol.67, pp.455–70, 2002.

[10] P.R. Lane and A. Tornell, "Power, growth and the voracity effect". Journal of Economic Growth, vol.1, pp. 213–241, 1996.

[11] H. Mehlum, K. Moene, and R. Torvik, "Institutions and the Resource Curse", Economic Journal, vol.116, pp. 1–20, 2006.

[12] J. A. Robinson, R. Torvik, and T. Verdier, "The Political Foundations of the Resource Curse", Journal of Development Economics, vol.79, pp. 447–68, 2006.

[13] A.K. Fosu, "Terms of Trade and Growth of Resource Economies: A Tale of Two Countries", Working Papers 28, UNU World Institute for Development Economics Research, 2011.

[14] P.K. Asea and A. Lahiri, The Precious Bane, paper presented to the Conference on Investment Growth and Risk in Africa, Oxford, April, 1997.

[15] W. Easterly, M. Kremer, L. Pritchett, and L.H. Summers, "Good policy or good luck? Country growth performance and temporary shocks", Journal of Monetary Economics, vol. 32, pp. 459–483, 1993.

[16] A. Dixit and R. Pindyck, "Investment under Uncertainty", Princeton University Press, Princeton, NJ, 1994.

[17] J. Cuddington, "Commodity export booms in developing countries", World Bank Research Observer, vol. 4, pp.143–165, 1989.

[18] I.M.D. Little, R.N. Cooper, W.M. Corden, and S. Rajapatirana, "Boom, Crisis, and Adjustment: The Macroeconomic Experience of Developing Countries", Oxford University Press, Oxford, 1993.

[19] P. Collier, J. Gunning, "Trade Shocks in Developing Countries", Oxford University Press, Oxford, 1999.

[20] A. Deaton and R. Miller, "International commodity prices, macroeconomic performance and politics in sub-Saharan Africa", Journal of African Economics, vol. 5, pp. 99–191, 1996.

[21] M. Bleaney and D. Greenway, "The Impact of Terms of Trade and Real Exchange Rate Volatility on Investment and Growth in Sub-Saharan Africa", Journal of Development Economics, vol. 65, pp.491–500, 2001.

[22] C. Blattman, J. Hwang, and J. Williamson, "The Impact of Terms of Trade Growth and Volatility in the Periphery 1870–1939", Journal of Development Economics, vol. 82, pp.156-179, 2007.

[23] E.G. Mendoza, "Terms-of-trade uncertainty and economic growth", Journal of Development Economics, vol. 54, pp.323–356, 1997.

[24] T. Bollerslev, "Generalized Autoregressive Conditional Heteroskedasticity", Journal of Econometrics, vol. 31, pp. 307-327, 1986.

[25] D. Holtz-Eakin, W. Newey, and H. Rosen, "Estimating Vector Auto-regressions with Panel Data", Econometrica, vol. 56, pp.1371- 1395, 1988.

[26] M. Arellano and S. Bond, “Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations”, Review of Economic Studies, vol.58, pp.277-297, 1991.

[27] M. Arellano and O. Bover, “Another Look at the Instrumental Variable Estimation of Error-Components Models”, Journal of Econometrics, vol.68, pp.29-51, 1995.

[28] P. P. Chen and R. Gupta, “An Investigation of Openness and Economic Growth Using Panel Estimation”, University of Pretoria, Department of Economics Working Paper, 22, 2006.

[29] H.S. Esfahani, “Exports, imports, and economic growth in semi-industrial countries”, Journal of Development Economics, vol.35, pp.93–116, 1991.

[30] J. Greene and D. Villanueva, “Private investment in developing countries”, IMF Staff Papers, vol. 38, pp.33–38, 1991.

[31] M. Lutz, “The Effects of Volatility in the Terms of Trade on Output Growth: New Evidence”**,** World Development, vol. 22, pp.1959-1975, 1994.